

**Department of Energy**

Oak Ridge Operations
P.O. Box 2001
Oak Ridge, Tennessee 37831—

91-527

July 26, 1991

Site:	SLAPS
Mod:	MOD980633176
Break:	10-9
Other:	Wkals
	7-26-91

Mr. Greg McCabe
U.S. Environmental Protection Agency
Region VII
726 Minnesota Avenue
Kansas City, KS 66101

Dear Mr. McCabe:

**DRAFT FINAL WORK PLAN FOR THE REMEDIAL INVESTIGATION/FEASIBILITY
STUDY-ENVIRONMENTAL IMPACT STATEMENT FOR THE ST. LOUIS SITE**

The purpose of this letter is to transmit the subject document and a summary of comment resolutions for your review. Comment resolutions were, in part, discussed at our meeting of June 5-6, 1991, in Kansas City. Based on the provisions of the Federal Facilities Agreements (FFA), EPA has 60 days to review this document and provide comments to DOE.

Please note that because of the late receipt of comments on this document from the Missouri Department of Natural Resources (MDNR) we were not able to resolve all of their comments and meet the commitments set forth in the FFA. Many MDNR comments, particularly those involving site geology, were resolved and are reflected in this draft. The remaining comments will be incorporated and a comment resolution summary completed during preparation of the next draft.

If there are any questions, please feel free to contact me.

Sincerely,

David G. Adler, Site Manager
Former Sites Restoration Division

Enclosure

cc: D. Bedan, MDNR
S. Liedle, BNI
J. Wagoner, DOE-HQ



**RESOLUTION OF EPA COMMENTS ON THE
ST. LOUIS SITE WORK PLAN**

General Comments

1. Comment noted.
2. An explanation of the sampling location identification system has been provided.
3. DOE does not consider the exclusion of thorium-230 analytical results from areas of elevated gamma activity to be an omission of data. Soil samples were collected and analyzed for thorium-230 from regions of the boreholes where gamma logging results had shown a decrease in the count rate, indicating a drop in the radium-226 concentration. Typically, this meant selecting samples for thorium-230 analysis from the top, middle, and bottom depths of the borehole. Any thorium-230 present in areas of elevated gamma activity will be cleaned up along with the gamma-emitting radionuclides. Maximum concentrations of thorium-230 for each property were determined from soil samples collected from boreholes exhibiting the highest level of gamma activity for each property based on downhole gamma logs (see the source term analysis, Appendix C).
4. The RI report for the St. Louis site provides more detail than
& the work plan by referencing published reports for each
5. of the properties investigated. These individual reports supply much of the detail you have requested. In addition, prior to the preparation of the work plan and the RI report, DOE and EPA agreed that this work plan would simply summarize completed field activities, and the RI report would summarize the activities and reference major reports for each of the properties. As decided in the meeting among EPA, DOE, and MDNR on June 5-6, 1991, in Kansas City, EPA will defer this comment until completion of the RI report review.
6. Comment noted. DOE had already completed characterization activities at the St. Louis site when TCLP replaced the EP tox. Current plans are to return to SLDS to collect samples from two areas that failed the EP tox for lead and analyze them using TCLP. In addition, chemical analyses of soil collected from the St. Louis site were performed. In general, concentrations of organic compounds (which are included in TCLP) are low, with the exception of those on portions of SLDS. The need for additional sampling and analyses utilizing TCLP is being evaluated and any additional sampling will be addressed in the field sampling plan for fulfilling data gaps.

7. This issue was discussed at the DOE/EPA/MDNR meeting June 5-6, 1991, and DOE indicated that the NEPA scoping requirements would be satisfied by a public scoping meeting to be held after the release of the work plan to the public. The intent of the scoping meeting is simply to take comments from the public on issues and concerns that they would like to be addressed during the site cleanup process. Public comments obtained at the scoping meeting will be incorporated into a NEPA implementation plan that documents public concern and is issued as an addendum to the RI/FS-EIS work plan or as a stand-alone NEPA document. It is important to note that the implementation plan is a documentation requirement that is unique to NEPA and that will not affect the content of the work plan. As such, EPA review is not required as part of FFA stipulations.
8. A brief discussion of the ALARA principle has been included at the location suggested, which is now on p. 2-56, paragraph 2.
9. Reference to the average radionuclide concentrations in surface soil at SLDS was removed from the text on p. 2-39 (now p. 2-61) and all tables and figures in Section 2.0.
10. The uranium-238 guideline of 50 pCi/g is based on the microcomputer program, RESRAD. DOE/CH-8901 is the Manual for Implementing Residual Radioactive Material Guidelines, the RESRAD code, which does provide the methodology for developing the guideline, considering various exposure scenarios and pathways. The result of running the RESRAD code for two separate scenarios was a maximum residual concentration of U-238 in soil of 210 and 880 pCi/g, depending on future land use at the St. Louis site. In the actual application of a cleanup guideline, it is very likely that a cleanup level substantially below the established guideline will be achieved. Application of ALARA and cost benefits indicates that a guideline of 50 pCi/g can be achieved at a nominal cost increase; therefore, a guideline of 50 pCi/g is assumed until final approval. Cleanup guidelines will be part of the ARARs determination for the site; therefore, a guideline has to be assumed at present. A brief explanation of how the 50 pCi/g assumed guideline for U-238 was established was added to the text.
11. This comment was addressed by Mr. Roger Halsey (BNI) during the EPA/DOE/MDNR meeting of June 5-6, 1991. A copy of Mr. Halsey's paper, "Protactinium-231 and Actinium-227 at the St. Louis Sites," is enclosed. In addition, soil samples will be retrieved from archive from depths identified as "clean" based on U-238, Ra-226, Th-232, and Th-230 analyses and analyzed for U-235 decay products through Th-227. These samples will be analyzed to determine whether Pa-321 and Ac-227 are present in the absence of U-238, Ra-226, Th-232,

and Th-230. Approximately 12 samples will be retrieved from archive: 7 from SLAPS and 5 from SLDS. Also, in the source term summary, Appendix C, an explanation was added to the text of how Pa-231 values were calculated from daughter radionuclide concentrations and of the error associated with estimating Pa-231 activity.

Specific Comments

- p. 2-4
para. 1 The water main crossing SLAPS has been added to Figure 2-25 (now 2-36).
- p. 2-7
para. 4-7 Information regarding Plants 6 and 7 at SLDS was added to the text on p. 2-5, paragraph 5, and 2-15, paragraph 1. A review of historical data did not reveal the disposition of construction soil and debris from the activities described.
- p. 2-14
para. 3 Comment incorporated. The year 1967 on p. 2-14 (now 2-15) should have been 1966.
- p. 2-14
para. 5 Oak Ridge National Laboratory (ORNL) performed a mobile gamma survey of the roads that could have been used during the transport of radioactive materials from SLDS to SLAPS. The results, which are scheduled to be published in two months, show no elevated gamma activity along the roadways. A copy of this report by ORNL will be forwarded to you when DOE receives it. DOE is presently conducting additional characterization activities along the railroads that traverse SLDS and could have been used for transporting radioactive materials; the results will be incorporated into an addendum to the St. Louis site RI report.
- p. 2-16
para. 5 Additional information has been included in the text on p. 2-18, paragraphs 1 and 2.
- p. 2-21 The geology section was rewritten, and clarification was added.
- p. 2-25
para. 4 Additional text was added to p. 2-33, paragraph 1.
- p. 2-25
para. 5 The text added to p. 2-33 should help clarify this.
- p. 2-28
para. 4 Text was added to p. 2-48 concerning height limitations.
- p. 2-30
para. 4 This paragraph (now on p. 2-50) was reworded for clarification.

- p. 2-31
para. 2 The reader has now been referred to Figure 2-5, which shows the former areas of land use and waste storage at HISS, not a specific burial location on the western portion of SLAPS.
- p. 31
para. 3 The radioactive materials currently stored at SLDS that are mentioned in this paragraph are under the control of Mallinckrodt. Additional text was incorporated into this paragraph (now on p. 2-53).
- p. 2-33
para. 2 A map (Figure 2-20) showing the radiological background sampling locations has been added. A short description of where the sampling locations are located is included as a footnote on Table 2-7. The current plans include collecting additional background samples, which will be analyzed for mobile ions and metals. These plans will be included in a separate transmittal.
- p. 2-33
para. 3 Plans for additional sampling will be described in a separate transmittal to EPA.
- p. 2-39
para. 2 Comment incorporated on p. 2-61.
- p. 2-39
para. 3 Text was added to p. 2-61 explaining why more detailed surveys are needed prior to remedial action.
- p. 2-40
para. 5 The text references the ORNL 1981 report and summarizes 1977 ORNL data. Table 2-11 and other building survey tables summarize the recently acquired BNI data, as stated in the text on p. 2-62.
- p. 2-43
para. 3 A table providing Building 101 survey results was not prepared because only three lines of data would be included in the table, and it seemed more sensible to summarize these data in the text; however, because it is the only building summary that did not have a table, one has been created (Table 2-18) and added to the report.
- p. 2-59
para. 5 A summary table has been added, and the text (p. 2-86) has been reworded to clarify the types of holes that were drilled.
- p. 2-59
para. 6 Yes, an attempt was made to determine whether both radioactive and chemical contamination are present at the same location. A sentence was added to the end of this paragraph (now on p. 2-86) stating where the chemical summary for the property may be found. The chemical summary explains the criteria for selecting sampling locations and summarizes the analytical results.

p. 2-71
para. 5

Surface drainage pathways were identified, and manholes were surveyed and/or sampled to determine whether residual radioactivity exists in the drainage pathways. The manholes serve a combined system of storm and sanitary sewers. DOE soil guidelines were used to determine whether contamination was present. As stated in this paragraph on p. 2-99, an attempt was not made to determine the extent of contamination. The sumps discharge waste to the Metropolitan Sewer District, which treats the waste, mixes it with other sewage, and discharges it to the Mississippi River; this information has been added to the plan. The reason for conducting further characterization just prior to remedial action is that SLDS is an operating facility and the ongoing operations may render characterization data invalid if there is a long time between characterization and remedial action. Enough information exists presently to develop the feasibility study.

p. 2-71
para. 6

The values in the text on p. 2-99 were corrected. Footnote c at the bottom of the table provides a conversion from pCi/L to $\mu\text{Ci/ml}$. The reason we use $\mu\text{Ci/ml}$ is for comparison to the regulations, which are reported in $\mu\text{Ci/ml}$. Because the primary operation at SLDS involved uranium processing, there is no reason to expect that thorium-232 is present in the groundwater. Soil results demonstrate that there are not significant areas of thorium-232 contamination on site and, therefore, groundwater was not analyzed for this radionuclide.

p. 2-74

DOE performed characterization activities in areas identified as contaminated based on ORNL's designation surveys. The figure referred to does represent a summary of all soil sampling locations at SLDS. A systematic sampling scheme was employed, along with biased soil sampling in areas identified as exhibiting elevated gamma activity based on walkover gamma surveys. DOE does recognize that additional characterization is required in some areas and is developing a field sampling plan to support such characterization activities, which will be submitted to EPA. Some characterization activities are being undertaken at this time. All additional sampling activities will be incorporated into the field sampling plan.

p. 2-80
para. 1

Comment incorporated on p. 2-99.

- p. 2-80
para. 2 Sampling at the SLDS vicinity properties is still in progress, and additional information on this will be the subject of a separate transmittal to EPA, as discussed during the EPA/DOE/MDNR meeting of June 5-6, 1991 (see p. 2-99).
- p. 2-81
para. 5 A map showing the locations of the eight private wells in the SLAPS vicinity has been included as Figure 2-34.
- p. 2-82 Because the intent of this work plan is only to summarize the remedial investigation data, coordinates for the 102 boreholes drilled at SLAPS and corresponding analytical data have not been provided. This information is available in the source document listed on the table of results of soil analyses at SLAPS. Based on discussions during the EPA/DOE/MDNR meeting of June 5-6, 1991, the average radionuclide concentrations have been deleted from the table.
- p. 2-84 DOE does not have an explanation for the decline of annual average external gamma radiation levels at SLAPS around 1986 shown in Table 2-35.
- p. 2-86 Yes, the average value for 1985 sampling at location 1 includes the 170 pCi/g reading. (See Table 2-36.)
- The figure has been modified to reflect that sampling locations 3 and 4 are surface water sampling locations only.
- p. 2-88
para. 1 Comment incorporated.
- p. 2-89 Text has been added to p. 2-109 providing a brief description of the background well locations, and a figure has been incorporated showing the background locations.
- p. 2-95
para. 2 The requested information is referenced in the St. Louis site RI report and may be found in the referenced documents in the degree of detail requested (see p. 2-117).
- p. 2-100
para. 3 Eva and Frost Avenues have been included in the text (p. 2-129) and the figure.
- p. 2-107
para. 2 Comment incorporated on p. 2-138.

- p. 2-107
para. 2 "Elevated" has been defined in the text on p. 2-138 as exceeding DOE remedial action guidelines. Even though surface soil samples from properties 5, 7, 9, 10, and 11 may have radionuclide concentrations exceeding 5 pCi/g, the background level is subtracted from these sample results before a decision is made concerning whether contamination is present. For subsurface soil samples, 15 pCi/g above background is the DOE remedial action guideline.
- p. 2-107
para. 5 Eva and Frost Avenues were added to the text on p. 2-138.
- p. 2-107
para. 6 The sediment sampling depths have been added to the text on p. 2-138. Approximately five samples did exceed DOE subsurface soil criteria.
- p. 2-107
para. 7 In 1986, sediment samples were collected from the sides of the creek, edge of the water, and center of the creek from SLAPS to HISS. In 1987, samples were collected from the center of the creek (where accessible), and 100 ft and 200 ft to the east and west of the creek's centerline from SLAPS to Pershall Road. Some samples were collected from private properties located in the floodway. Text was added to p. 2-138 stating this and the interval of sampling downstream.
- p. 2-113
Fig. 2-34 The city parks located between SLAPS and Old Halls Ferry Road have been added to Figure 2-45. Yes, samples were collected from stretches of the creek within the parks: Khoury, St. Cin, Duchesne, St. Ferdinand, and Wedgewood.
- p. 2-121
para. 4 Comment incorporated on p. 2-148.
- p. 2-130 Comment incorporated on Figure 2-52.
- p. 2-134
para. 3 Text was added providing more information on the gross alpha data. (See p. 2-161.)
- p. 2-147
para. 2 Clarification was provided on p. 2-172. During Phase I, 59 of the 109 total boreholes were sampled.
- p. 2-152
para. 2 As a result of the EPA/DOE/MDNR meeting of June 5-6, 1991, the additional sampling at SLDS and TCLP analysis will be the subject of a separate transmittal to EPA. (See p. 2-179.)

- p. 2-157
para. 3
&
p. 2-159
para. 3 As stated in the text, the biased chemical samples were taken from locations where radiological boreholes had previously been drilled. The biased chemical sampling was conducted in this manner to identify whether mixed waste was present on the site. Random sampling was designed to provide a total chemical characterization of the entire site. Table 2-60 has been added giving the analyses performed on given depth intervals for the biased and random boreholes.
- p. 2-161
para. 4 The sentence on landfilling activities at the ball field area was deleted from p. 2-194, per discussions during the EPA/DOE/MDNR meeting of June 5-6, 1991. The presence of radioactive contamination at a depth of 10 ft is likely the result of construction work along that area of Coldwater Creek during 1988. Yes, QA/QC documentation was reviewed.
- p. 2-164 The average levels on Table 2-63 were determined using detection limit values (please see footnote c).
- p. 2-173
para. 5 These requested results have been added to the work plan in Table 2-70.
- p. 2-177
para. 2 Text has been added under the discussion of groundwater at the Latty Avenue Properties (p. 2-211). Groundwater was analyzed for priority pollutant organics in January 1989.
- p. 2-177
para. 6 The paragraph (on p. 2-211) was reworded, leaving out reference to primary contaminants.
- p. 2-178 The average levels on Table 2-71 were determined using detection limits values (please see footnote c).
- p. 2-184
para. 1 Per discussions during the EPA/DOE/MDNR meeting of June 5-6, 1991, the sentence explaining the fluctuation in groundwater concentrations has been deleted. (See p. 2-218.)
- p. 2-184
para. 5 Text was added under the discussion of groundwater at SLAPS. Groundwater was analyzed for priority pollutant organics in January 1989.
- p. 3-7
para. 2 The last sentence of this paragraph has been deleted.
- p. 3-7
para. 3 The sentence has been revised by deleting the word "industrial."
- p. 3-10
para. 2 Comment incorporated.

p. 3-15
para. 1 The last sentence of this paragraph has been deleted,
per discussions during the EPA/DOE/MDNR meeting of
June 5-6, 1991.

p. 3-16 Comment incorporated.

p. 3-19
para. 1 Section 3.5.1, Selection Criteria for Remedial Actions,
has been revised.

p. 3-27
para. 4 Comment noted.

p. 3-28
para. 2 The need for treatability studies, if any, will be
identified in the initial screening of alternatives.
As specified in the FFA, this initial screening is a
primary document scheduled for submittal to EPA in the
2nd quarter of FY 1992. Treatability study schedules,
if warranted, will be submitted at that time.

p. 3-28
para. 6 40 CFR 190 and 191 have been added to Appendix E.
40 CFR 192 is already in this Appendix.

p. 5-3
para. 1 Please see response to general comment 7.

p. 5-6
para. 6 The paragraph has been removed, per discussions with
EPA during the EPA/DOE/MDNR meeting of June 5-6, 1991.

p. 5-7
para. 6 The present format was agreed upon previously between
EPA and DOE. The material in the suggested RI report
format outline in EPA's Guidance for Conducting
Remedial Investigations and Feasibility Studies Under
CERCLA has been covered in the RI report. The basic
outlines for these documents were established during a
meeting among DOE, MDNR, and EPA on January 10-11, 1990
(see attached memorandum). The baseline risk
assessment will be published as a separate document,
and this document covers contaminant fate and
transport.

p. 5-10
para. 4 The FS report outline has been replaced with the one
identified in the EPA guidance document. (See
p. 5-10.)

p. 6-2 The schedule has been revised.

p. 7-1
para. 2 Science Applications International Corporation (SAIC)
is the current environmental studies contractor.

p. C-1 These comments were addressed by Mr. Roger Halsey
para. 1 during the EPA/DOE/MDNR meeting of June 5-6, 1991.
and A copy of Mr. Halsey's paper, which explains the
p.C-7 rationale for not analyzing for Pa-231 and how the
para. 4 isotopes in the uranium decay chains may be estimated,
 is enclosed.

p. C-9 Footnotes have been added to all the tables in this
 appendix explaining how maximum and average
 radionuclide concentrations were obtained.

Table E.2 Radium-226 and radium-228 have been added to the table.
p. 7

Note: DOE is preparing a quality assurance project plan (QAPjP) and a field sampling plan (FSP), as requested by EPA (see the attached memorandum from Jeffrey A. Wandtke to Greg McCabe, May 17, 1991, Work Plan for the RI/FS-Environmental Impact Statement, St. Louis Airport Site (SLAPS), St. Louis, Missouri). DOE did not prepare a QAPjP and an FSP when this work plan was generated because the RI work in St. Louis was essentially complete. We do, however, understand that it is difficult to evaluate the data quality control measures; therefore, based on the DOE/EPA/MDNR meeting of June 5-6, 1991, DOE is now preparing a QAPjP and FSP. Our contractor staff has been in contact with Mr. John Gilchrist to ensure that the approach taken in preparing these documents is satisfactory.

RESOLUTION OF EPA COMMENTS ON THE ST. LOUIS COMMUNITY RELATIONS PLAN

GENERAL COMMENTS

1. When discussing the completeness of the characterization work at each site, we suggest the addition of a caveat explaining that the work completed to date has not yet undergone EPA review.

The following statement was added to p. 6, paragraph 1; p. 10, paragraph 3; and p. 14, paragraph 5: Work accomplished to date has not yet been reviewed by EPA

2. We note that DOE has hosted only one site-specific public meeting (in 1981). Given the level of public interest at this site, we suggest modifying the plan to go beyond public participation activities specifically required by law, and make provisions for the hosting of public meetings at more frequent, strategic points.

Bullets were added to Section 5.0, pp. 28-30, under community relations activities, technical milestones 3, 4, 6, 7, and 8 that state the following:

- Provide opportunity for public meeting if there are unexpected discoveries or as needed to explain site activities

p.
par

Figure 4 (p. 31) was changed indicating the opportunity for public meeting during each technical milestone.

SPECIFIC COMMENTS

- p. iii The FUSRAP acronym should be defined in the first paragraph, not the second.

The FUSRAP acronym has been defined in first paragraph requested.

- p. 9,
para. 1 All the city parks along Coldwater Creek between SLAP and the Missouri River should be included here.

p. 13,
para. 1 The discussion of the Latty Avenue properties should be made clear with respect to the times of creation of the two storage piles, and how much material is contained in each.

The discussion of the storage piles was expanded to include the following text: An additional 14,000 cubic yards of contaminated soil, from cleanup along Latty Avenue in 1984 and 1985 and from an area used for office trailers and a decontamination pad, was added to the pile. Approximately 4,600 cubic yards of contaminated soil was stored adjacent to the existing pile; the soil was excavated during road and drainage improvements along Latty Avenue in support of a municipal storm sewer project. A total of approximately 32,000 cubic yards of contaminated soil is stored at the property.

p. 22,
para. 2 The purpose of this paragraph, and the reason for its location in this section summarizing community concerns, is unclear.

The first two lines of the paragraph were deleted, and the remainder of the paragraph describing the administrative record was moved to Section 4.0, p. 25, Highlights of the Community Relations Program.

p.28,
bullets
7 & 8 When was the public informed by DOE of the availability of EPA's TAG program, or alternatively, when will the public be informed of such by DOE?

During the scoping/planning meeting now scheduled for early next calendar year, the public will be notified of EPA's TAG program. Administration and funding procedures will need to be defined by EPA and DOE before the public is notified.

"During the scoping/planning presentation" was added to the seventh bullet.

p. A-2 The telephone numbers should be changed to the following:
 M. Kay--551-7006
 R. Morby--551-7052
 G. McCabe--551-7052
 R. Michaels--551-7003

p. A-2 Morris Kay's correct title is Regional Administrator.

p. A-3 Ms. Eichenser's correct title is Community Relations Coordinator.

The above changes were made, as requested.

Protactinium-231 and Actinium-227 at the St. Louis Sites

Recently, there has been interest in the levels of the radioisotopes protactinium-231 (Pa-231) and actinium-227 (Ac-227) at the St. Louis sites. These isotopes are decay products or "daughters" of uranium, and are associated with uranium contamination. They have relatively large dose conversion factors, compared to other uranium daughters and the parent uranium isotopes. That is, for equivalent levels of activity, they would provide a greater exposure than the other daughters. Varying levels of uranium-238 (U-238), uranium-235 (U-235), and their daughters are found at the sites. An analysis of the relative effects from Pa-231 and Ac-227 must include both their relative concentrations and dose factors.

The contamination at the St. Louis sites originated from the processing of uranium ore during the early days for the nation's atomic energy program. The processing operations were conducted at the St. Louis Downtown Site (SLDS), and consisted of removing the uranium from the ore. The residues from these processing operations were later disposed at the St. Louis Airport Site (SLAPS) and the Hazelwood Interim Storage Site (HISS). Additionally, residual contamination from these activities has been found on the properties and roadways adjacent to SLDS, SLAPS, and HISS.

Natural uranium ore has both U-235 and U-238. Each of these has a chain of decay products, for a total of 32 separate radioisotopes. See figures 1 and 2 for a complete list of the isotopes. The activity of the daughters in the original ore is in equilibrium. That is, in each chain they have been undisturbed long enough for the decay rates to achieve a balance with the much longer lived parent. Their activities are approximately equal to that of the parent. Given the activity of any member of the chain,

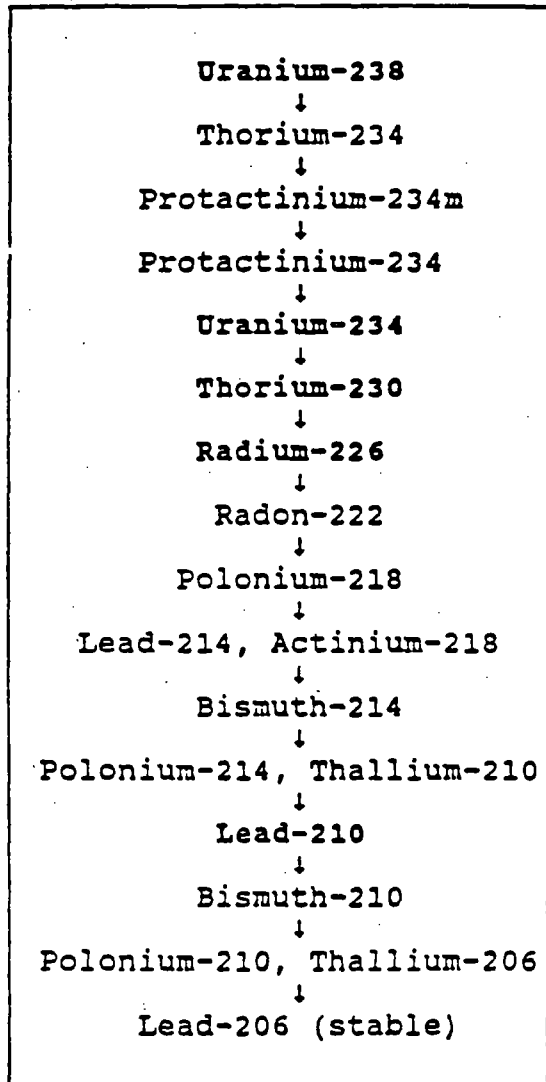


Figure 1 Uranium 238 decay chain

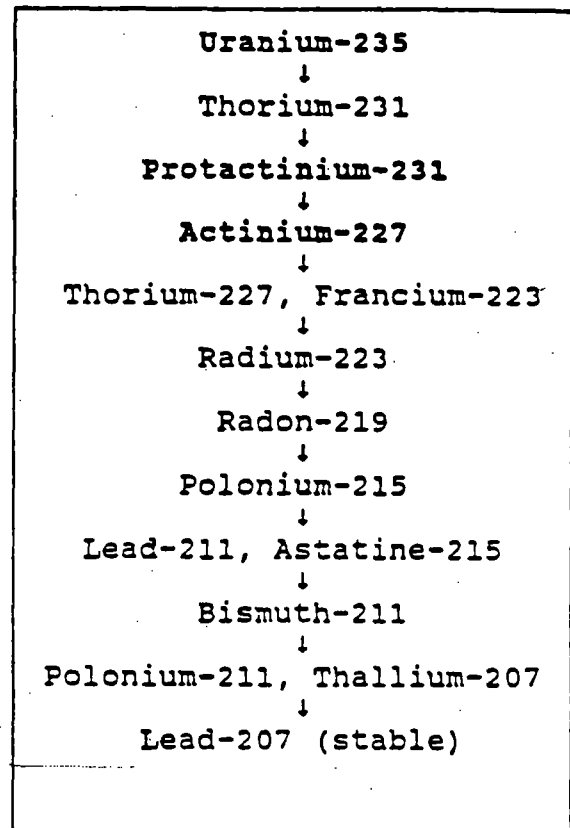


Figure 2 Uranium 235 decay chain

Note: The isotopes in bold face type have half-lives greater than one year.

the activities for all isotopes in the chain can then be estimated. Also, in natural uranium, the ratio of U-235 to U-238 remains constant with the activity of U-235 at about 5% of U-238. So, given the activity concentrations from one uranium chain, the activities of the isotopes in the other chain may also be estimated.

The ores were processed and most of the uranium was removed leaving behind the daughters and residual uranium. This chemical processing, along with selective removal of certain, high activity residues has thrown the daughters out of their original equilibrium.

During initial sampling of the wastes, Ac-227 and Pa-231, daughters of U-235, were not investigated. It was expected that their activities would be relatively small because of the 5% ratio. Also, they require specific laboratory procedures to separate the samples chemically and then analyze for their alpha or beta activity. The decision was made to not analyze for Pa-231 and Ac-227. The rationale was the difficulty in analysis, along with the fact that other daughters in the same wastes were much easier to track. This is not to say that Pa-231 and Ac-227 were not known to be present, but that they were part of a collection of isotopes, certain of which at much higher concentrations. The isotopes that had the higher activities were used as indicator isotopes.

In order to determine if some of the daughter isotopes that occur in smaller quantities, such as Pa-231 and Ac-227, were migrating differentially from the wastes, samples were collected during the fourth quarter of 1990 and analyzed for gross alpha and gross beta activity. The results agreed fairly well with the isotopic analysis of the indicator isotopes. Therefore, the isotopes not being monitored did not appear to be separating from the indicator isotopes.

The radiations that the radioactivity emit can be detected by simple instruments. The wastes and any associated contamination can

be located and monitored with field instrumentation. These field instruments cannot determine how much of any particular daughter they are detecting, but that is not important to locate and manage the wastes or for contamination control.

However, when doses to the population or doses to workers handling the soils are calculated, the concentrations of all the daughters need to be determined. Many of the decay daughters are very short lived, some in terms of seconds and minutes. These may be assumed to grow into equilibrium with the longer lived parents, above them in the chain. This reduces the isotopes of interest to five in the U-238 chain and three in the U-235 chain. The three in the U-235 chain are U-235, itself, Pa-231, and Ac-227.

Concentrations for the eight isotopes mentioned above are listed in Table 1. The table includes results from the Hazlewood Interim Storage Site (HISS), and averages of results for the St. Louis Downtown Site (SLDS) and the St. Louis Airport Site (SLAPS). Isotopic analysis was conducted on samples of contaminated soil, collected during the initial site characterization studies in 1986 for HISS and SLAPS, and in 1988 and 1989 for SLDS.

The activity in the wastes is dominated by thorium-230 (Th-230), a daughter of U-238. Ac-227 and Pa-231 are also present, but, as expected, they are found to be in concentrations much less than the Th-230. However, as stated above, they have much higher dose conversion factors so their effect can be a significant fraction of the total dose, depending on the concentrations and the type of dose.

The doses to people fall into three broad classes; the external dose from radioactivity in the ground, the internal dose from inhaled radioactivity in suspended contaminated dust, and the internal dose from ingested radioactivity in food or water. The dose from each isotope varies since each has a different decay rate and each is handled differently within the body. Complicating the

Table 1

Isotope	SLDS	SLAPS	HISS
U-238	94.0	35.6	370
U-234	105	36.2	420
Th-230	111	2858	28000
Ra-226	15.6	22	220
Pb-210	19.3	42.2	520
U-235	6.31	1.5	24
Pa-231	2.28	22.2	240
Ac-227	2.57	21.2	290

Note: The activities listed represent averages for many samples. The activities listed for Pa-231 are inferred from daughter isotopes.

Table 2

Isotope	External	Inhalation	Ingestion
U-238+	0.0697	0.12	0.00025
U-234	0.000697	0.13	0.00026
Th-230	0.00103	0.26	0.00053
Ra-226+	8.56	0.0079	0.0011
Pb-210+	0.00231	0.021	0.0067
U-235+	0.49	0.21	0.00025
Pa-231	0.121	0.86	0.011
Ac-227+	1.52	1.2	0.015

Note: The dose conversion factors are taken from DOE/CH/8901, "A Manual for Implementing Residual Radioactive Material Guidelines." The factors have the units of millirem per picocurie for inhalation and ingestion and millirem per year / picocurie per cubic centimeter for external.

* Questions have been raised whether the activity of Pa-231, with a half-life of 32500 years can be calculated from its immediate daughter, Ac-227 with a half-life of 21.6 years. Although both are Actinide elements, they do not have identical chemical properties and may have been in disequilibrium in the processed ore residues. After two half lives of the daughter, or 43.2 years, the activity of the daughter would be 75% of the parent's original activity + 25 % of the original activity of the daughter; assuming the parent activity does not change significantly in the 43 years. (It actually changes by less than 0.1%.)

Therefore, the activity of Pa-231 may be underestimated by 25% if there were absolutely no Ac-227 in the original ores or it may be overestimated by 100% if the Ac-227 was five times as great as the Pa-231 in the original ores. The amount may be overestimated by a great deal, depending on the original ratio, but it cannot be underestimated by more than 25%. Overestimating the amount errs on the conservative side. If there is truly less, the resulting doses from exposure to the wastes would be less.

The same argument carries through to the estimation of Pa-231 from the activity of Th-227, the immediate daughter of Ac-227. Th-227 has a half-life of 18.2 days and may be assumed to be in equilibrium with Ac-227 after the 43 years. The errors in estimating Pa-231 are, therefore, the same.

matter is the fact that uranium and uranium daughters can be found in all soils, food, air, and water and provide part of the natural background radiation everyone receives.

The results from the isotopic analysis were used to calculate the relative dose contributions from each of the members of the uranium decay chains for the three pathways. To simplify the results and take the conservative approach, the dose contributions for the shorter lived daughters are included with the longer lived parents and are assumed to be in equilibrium. The dose factors for each of the three pathways for the eight isotopes of interest, which include the shorter isotopes factors summed with their parents, are listed in Table 2.

The relative dose factors were calculated for naturally occurring uranium in Figures 3 to 5, Figures 6 to 8 for SLDS, Figures 9 to 11 for SLAPS, and Figures 12 to 14 for HISS.

Ac-227+ and Pa-231 account for 14.7% of the dose from the inhalation pathway and 11.9% from the ingestion pathway for naturally occurring uranium. They account for practically none of the external dose. The calculated dose from the Ac-227 activity dose include only Ac-227 but the effects from an additional ten very short lived daughters, indicated in the figures and the text by the "+" after the isotope.

Certain areas of SLDS appear to be primarily uranium contamination. These were mathmatically averaged with other areas that included elevated daughter concentrations. Actual dosimetry would vary across the site, but the average for the site follows closely the natural uranium ratios. There is more Th-230 which shifts the balance in the inhalation and ingestion pathways, but the Pa-231 plus Ac-227+ influence is similar to natural uranium with less of the inhalation dose (8.3%) and more of the ingestion dose (19.8%).

However, the analysis shows the daughter concentrations for

SLAPS and for HISS to be very far from the natural ratios. This is not unexpected as the contamination at these sites came from stored ore residues. The high activity of Th-230 dominates the inhalation dose at greater than 90%, and provides approximately 60% of the ingestion dose. The rest of the ingestion dose is divided about equally among lead-210 and its daughters (Pb-210+), Pa-231, and Ac-227+. Also, interestingly, Ac-227+ provides a significant fraction of the external dose, 18% at SLAPS and 14% at HISS.

In summary, the contamination at all of the sites can be located and controlled by monitoring the radiations, without regard to specific isotopic ratios. Whenever doses are calculated, actual site isotopic ratios will provide a better estimate than using natural ratios. The increased accuracy depends on which pathway or combination of pathways is of concern. Pa-231, Ac-227, and the remaining daughters of U-235 will provide a significant fraction of the total dose for most scenarios. The best estimate of any exposure must include an estimate of their activities.

079700

079593

Relative Contributions - External

Natural Isotopic Ratio

All Others (0.000) (0.000)



Figure 3

Relative Contributions - External

BLDS Isotopic Ratio

U-235+ (4.350) (0.000) (0.000) Ac-227+ (0.000) (0.000) (0.000)

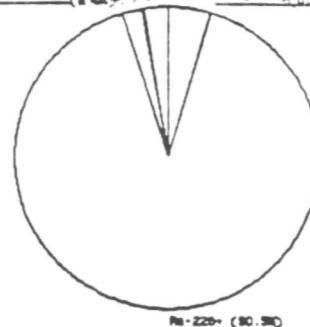


Figure 6

Relative Contributions - Inhalation

Natural Isotopic Ratio

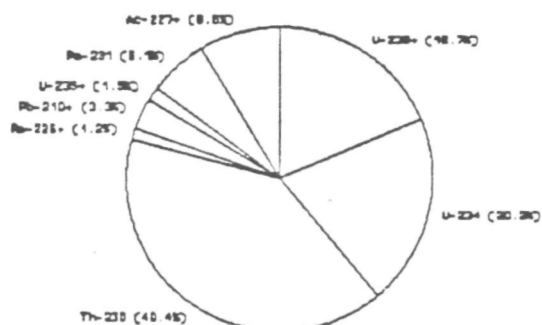


Figure 4

Relative Contributions - Inhalation

BLDS Isotopic Ratio

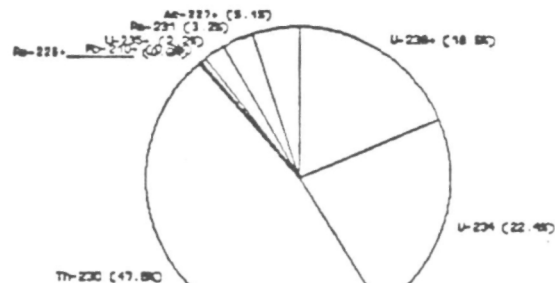


Figure 7

Relative Contributions - Ingestion

Natural Isotopic Ratio

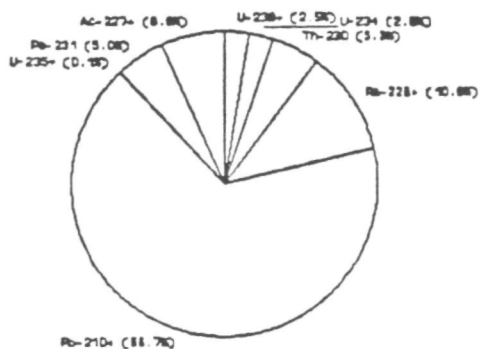


Figure 5

Relative Contributions - Ingestion

BLDS Isotopic Ratio

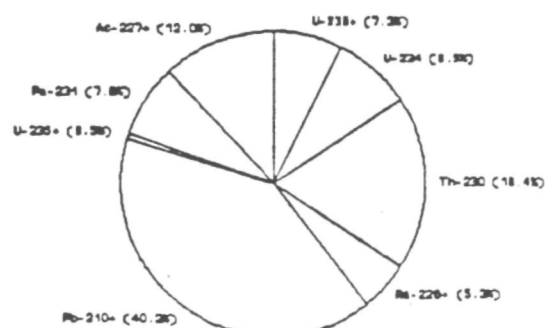


Figure 8

072700
079593

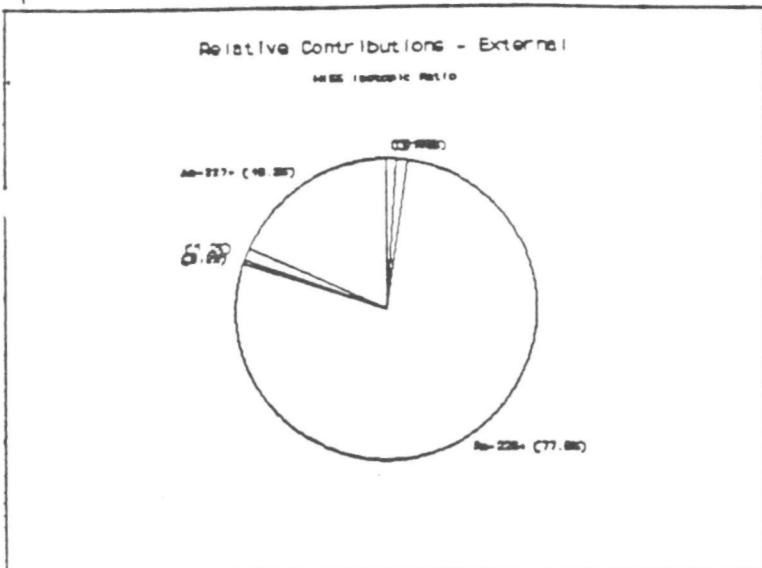


Figure 9

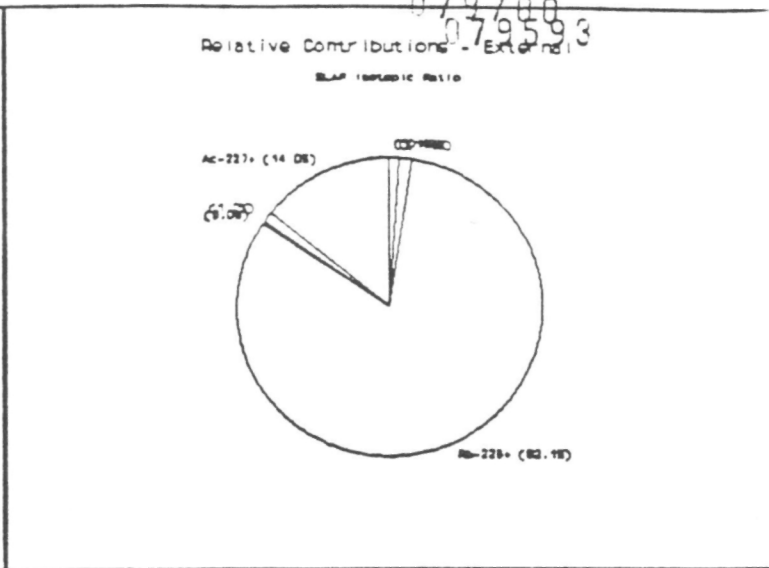


Figure 12

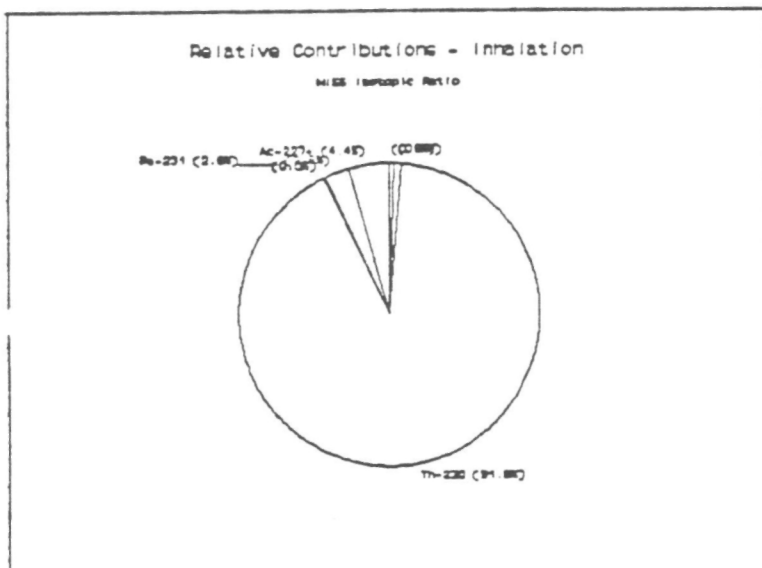


Figure 10

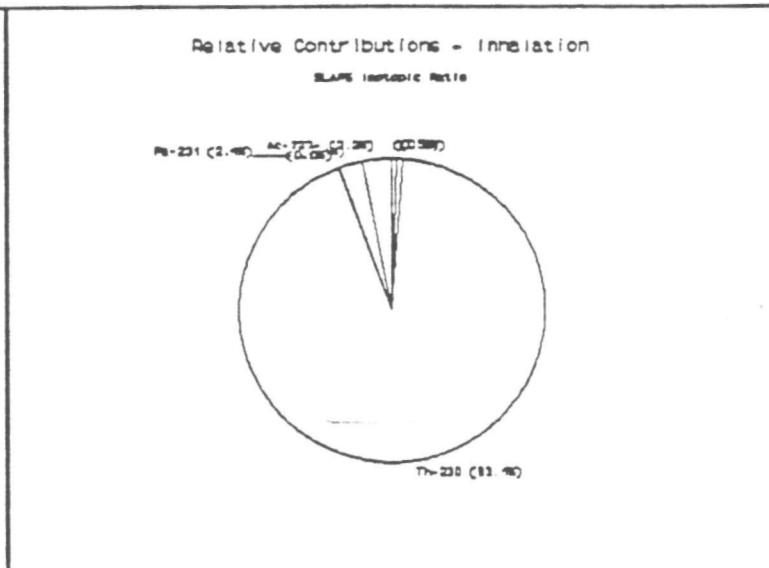
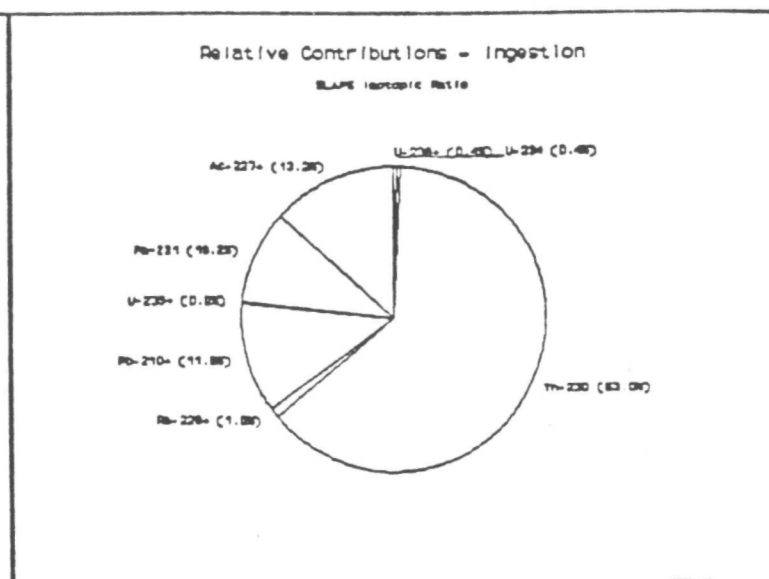
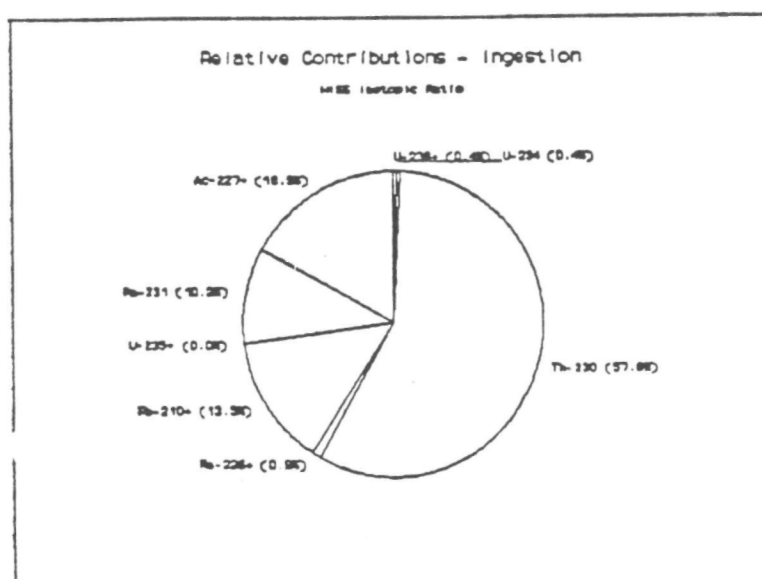


Figure 13



**Department of Energy**

Oak Ridge Operations

P.O. Box 2001

Oak Ridge, Tennessee 37831 - 8723

1/26/90

Mr. Gene Gunn
U.S. Environmental Protection Agency,
Region VII
726 Minnesota Avenue
Kansas City, Kansas 66101

Dear Mr. Gunn:

MEETING MINUTES

The purpose of this letter is to provide draft minutes and associated actions from our meeting of January 10-11, 1990. Please comment and return so that I may incorporate comments and finalize the minutes and actions.

I believe our meeting was productive and look forward to meeting with you again in the near future.

Sincerely,

A handwritten signature in dark ink, appearing to read "David G. Adler", is written over the word "Sincerely,".

David G. Adler
Site Manager
Technical Services Division

Enclosure:
As stated

cc: S. D. Liedle, BNI

MEETING MINUTES
St. Louis FUSRAP Sites
MODNR/EPA Region VII/DOE
January 10-11, 1990

Attendees: D. Bedan (MODNR), G. Gunn (EPA, Region VII),
D. Adler and B. Atkin (DOE-OR), S. Liedle,
K. Noey, and J. Williams (BNI)

The purpose of the meeting was to discuss radiological characterization results from previously completed work and plans/assumptions for completion of the Work Plan and RI report. The discussion of characterization results focused on radiological results for SLAPS, HISS, FUTURA, and various vicinity properties including those along Latty Avenue, Coldwater Creek, and the Haul Roads. The discussion on the Work Plan and RI reports focused on their content, given the fact that major portions of the investigation work has been completed and summarized in reports. Major topics of discussion, and actions are listed below:

- (1) Extensive characterization of the St. Louis sites has previously been completed. As a result, the work plan submitted for public review for the St. Louis sites will contain summaries of existing characterization data to help substantiate the lack of additional data requirements (i.e., data gaps). Since no significant investigative work is anticipated after publication of the work plans, field sampling plans, and quality assurance project plans will not be prepared. Quality assurance/quality control measures taken during previously completed work will be summarized in the work plan.
- (2) A community relations plan will be prepared and issued with the work plan. Given the current level of community concern, it was agreed to expedite preparation of this plan or provide MODNR/EPA with a list of anticipated short-term (i.e., 2-4 month) community relations activities. It was agreed that MODNR/EPA would have an opportunity to assist in the selection and implementation of these near-term community relations activities, as appropriate. **ACTION:** DOE provide list to MODNR/EPA and evaluate expedited plan preparation including a completion date (FEB 1990).

-2-

- (3) Some "follow-on" characterization to work that has already been initiated is needed on a number of properties. In order to expeditiously complete this work, a sampling plan describing the characterization will be prepared. This sampling plan will cover characterization activities planned for properties adjacent to SLDS, downstream reaches of Coldwater Creek, along the Haul Roads between SLDS and SLAPS, and between HISS and Westlake Landfill. This plan will be submitted to MODNR/EPA for review and approval. ACTION: DOE submit plan to MODNR/EPA (MAR 1990).
- (4) The RI report for the St. Louis sites will directly incorporate a number of previously published characterization reports. The RI report will also contain summary sections designed to facilitate review and utilization of RI data for utilization in Feasibility Study activity. It was agreed that MODNR/EPA formal comments on the sufficiency of available site data would occur primarily in response to the RI report (rather than the RI/FS Work Plan) due to the status of completed field activities, and the expected timing of documentation activities. MODNR/EPA will be provided with opportunity to informally review draft characterization reports as early as is practicable.
- (5) The level of detail needed for the baseline risk assessment for the sites was discussed. At issue is the level of detail/analysis needed to support the planned uses of the assessment versus the need for consistency between FUSRAP sites and other DOE programs, especially Weldon Spring. ACTION: EPA Region VII provide DOE with risk assessment document developed for Times Beach (FEB 1990). DOE develop outline/plans/assumptions for risk assessment and supply to MODNR/EPA (MAR 1990).
- (6) Recognizing the need for enhanced DOE presence in the St. Louis area, DOE committed to investigating options for the establishment of a site office.
- (7) MODNR suggested that DOE establish a third public reading file at the public library in Clayton. ACTION: DOE set up file in Clayton.
- (8) EPA asked to be informed of dates on which DOE will conduct remaining community interviews so that they can participate. ACTION: DOE notify EPA prior to any future community interviews.
- (9) It was agreed that a meeting to discuss radiological and chemical characterization results for the St. Louis Downtown Site be set up for January 23 in Kansas City. ACTION: EPA contact J. Fraunhoffer at SLDS and request meeting.



Department of Energy

Oak Ridge Operations
P.O. Box 2001
Oak Ridge, Tennessee 37831-8723
March 13, 1990

066928
066862

90-150

Mr. Gene Gunn
U.S. Environmental Protection Agency
Region VII
726 Minnesota Avenue
Kansas City, Kansas 66101

Dear Mr. Gunn:

ISSUES CONCERNING PREPARATION OF ST. LOUIS, MISSOURI WORK PLAN

The purpose of this letter is to describe our proposed approach for preparation of the St. Louis, Missouri Remedial Investigation (RI) Report. Enclosed is a copy of the outline that we propose to follow during preparation of the RI report.

The text of the report will be prepared to meet Environmental Protection Agency (EPA) requirements for RI report content. As you are aware, the St. Louis, Missouri RI is a different situation from most RIs in that the bulk of the field work was completed without a formalized field sampling plan. In addition, it is expected that essentially all RI field activity will be completed prior to issuance of an RI/FS work plan document for public review. Accordingly, the work plan is being prepared to summarize completed field activities rather than to provide a field sampling plan. Remaining RI fieldwork will be described in a focused field sampling plan which will be submitted for EPA review.

The main topics to note concerning the approach in preparation of the RI report are:

- Under Section 1.2, we will explain that the surveys were conducted on the following properties and then list all the properties as part of either the St. Louis Downtown Site (SLDS) and vicinity properties (VPs), the St. Louis Airport Site (SLAPS) and VPs, or the Latty Avenue Properties. This will permit the reader to place each area characterized in perspective. Graphics showing the various study areas will be included in the report to help readers not familiar with the sites.
- Chapter 2.0 will provide brief descriptions of how and where sampling was conducted on the properties.

Mr. Gene Gunn

2

- Chapter 2.0 will include a section on quality assurance measures and objectives since there will not be a separate quality assurance project plan.
- Chapter 3.0 will summarize the nature and extent of contamination at each of the three main areas: SLDS and VPs, SLAPS and VPs, and Latty Avenue Properties. Any other relevant information on site conditions, such as geotechnical information, will also be presented for each of the three main areas. In Chapter 3.0, the major reports for each of these properties will be referenced as an appendix to the RI report. The published reports, which will be included in the RI report, are indicated on the attached bibliography.
- Chapter 4.0 will briefly state contaminant fate and transport for all the St. Louis, Missouri FUSRAP properties. Since the radiological contaminants at the sites are the same, a separate description for each of the three main areas will not be provided.
- Chapter 5.0 will essentially be a paragraph stating that a baseline risk assessment is being prepared under separate cover.
- Chapter 6.0 will include summaries and conclusions in a very brief way since the bulk of the RI will have been reported in Chapter 3.0.

Currently, the RI report is scheduled to be issued to DOE as a draft in August 1990. If you have any questions or comments concerning this proposed approach to preparing the report, please contact me or Steve Liedle at (615) 576-3997.

Sincerely,



David G. Adler
Site Manager
Technical Services Division

Enclosure:
As stated

cc: S. D. Liedle, BNI